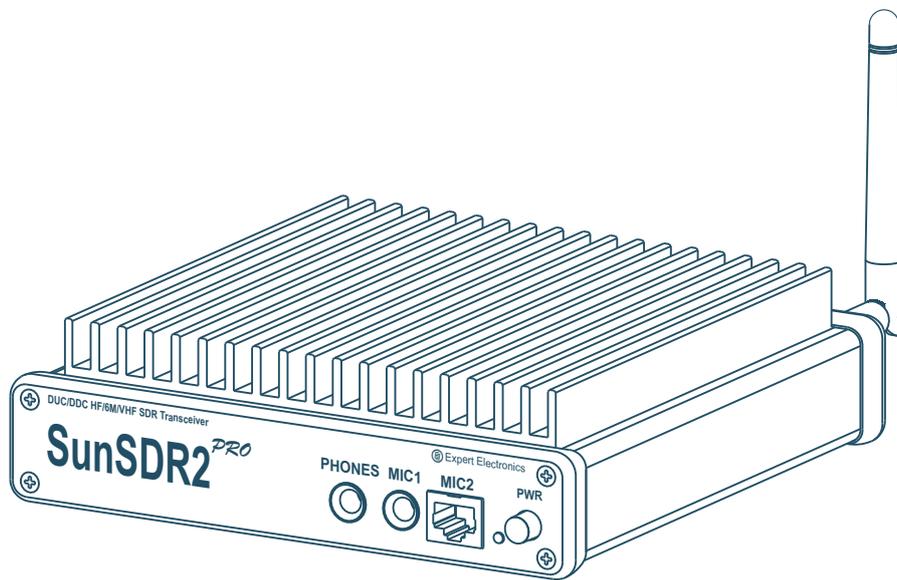


# SunSDR2<sup>PRO</sup>

DUC/DDC HF/6M/VHF SDR Transceiver



## Hardware manual

V1.1

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## IMPORTANT

**READ THIS INSTRUCTION MANUAL CAREFULLY** before attempting to operate the transceiver.

**SAVE THIS INSTRUCTION MANUAL.** This manual contains important safety and operating instructions for the SunSDR2-PRO.

### 1. Operating rules

- Visually inspect the SunSDR2 PRO transceiver for the absence of mechanic damages before connecting it to PC;
- Learn attentively the manual, before using the Transceiver. Connecting and operation of the Transceiver without the instructions can bring to the fatal errors;
- If Transceiver was held in the climatic conditions, different from the operational, it is recommended not to switch it on within 2 hours holding it in operational conditions;
- Connecting the Transceiver to a PC should be done in accordance with the connection diagram, given in the Manual;
- Check the presence of the ground connection of the PC and the ground wire of the antenna connector (SMA) of the Transceiver before switching;
- It is forbidden to connect the Transceiver to PC with the voltage presence on it or in the switched condition;
- It is forbidden to use the power supply with the voltage more that +16 V. *Remember! The transceiver's power is the voltage direct current!*
- Before connecting the external devices to connector EXT CTRL read the Manual, learn the tables and the diagrams of connecting the external devices;
- Remember! The transistor switches have the limitations over supply voltage and current, going through them. The power swap is forbidden;
- It is forbidden to use the Transceiver in the temperatures lower than 0°C (32°F) and higher than +75°C(167°F);
- It is forbidden to use and store the Transceiver in the dusted rooms and on exposure to direct sunlight;
- Avoid exposure of the atmospheric precipitations on the Transceiver. Never spill any liquids (especially aggressive) on the Transceiver;
- It is forbidden to use the Transceiver during storms;
- Don't open the Transceiver. It contains the radio elements, which have the high-sensitivity to the static electricity. This document contains all the necessary information about the internal design to satisfy the curiosity of Users. To repair the Transceiver ask the manufacturer;
- Always unplug the Transceiver's antenna, if you don't control it or if there appear a danger of atmospheric electricity damage;
- Save the Transceiver, cables and wires from the influence of the magnetic pickups (emergency states), out controlled currents and voltages and the domestic animals;

- To exclude the damage of the devices and not to produce the harmful interference on air don't allow to control the Transceiver people with the doubtful reputation;
- Keep out of the reach of children.

## 2. Technical characteristics

|  |                                       |
|--|---------------------------------------|
| General coverage receiver in HF, MHz         | 0.09...65                             |
| General coverage receiver in VHF, MHz        | 95...148                              |
| Frequency coverage in HF in TX mode, MHz     | All HF and 6m amateur frequencies     |
| Frequency coverage in VHF in TX mode, MHz    | 144...148                             |
| Sensitivity, uV                              | 0,07                                  |
| Maximum transmitter's output power in HF, W  | 15                                    |
| Maximum transmitter's output power in VHF, W | 7                                     |
| Blocking dynamic range in HF mode (BDR), dB  | 129                                   |
| Blocking dynamic range in VHF mode (BDR), dB | >114                                  |
| RF ADC clock frequency, MHz                  | 160                                   |
| RF ADC resolution, bit                       | 16                                    |
| RF DAC clock frequency, MHz                  | 640                                   |
| RF DAC resolution, bit                       | 14                                    |
| Recommended power supply, V                  | 15                                    |
| Supply voltage range, V                      | 12...16                               |
| Local oscillator's stability, ppm            | +/- 0.5                               |
| Maximum consumption current, A               | 5                                     |
| Built-in audio codec resolution, bit         | 24                                    |
| ALC input voltage range, V                   | 0..4                                  |
| Dimensions, mm (inches)                      | 165x165x35 (6" 1/2 x 6" 1/2 x 1" 3/8) |
| Operating temperature, °C (°F)               | 0(32) to +75(167)                     |
| Weight, kg (lbs)                             | 1,5 (3.3)                             |

### 3. Local operation

Local operation is when SunSDR2 PRO transceiver is connected directly to a PC's Ethernet port with CAT5 cable. Make connections to the transceiver over the following steps below:

1. Connect headphones and microphone to the transceiver. If you have an electret microphone or PC headset, connect the microphone to jack MIC1. If you have a dynamic microphone, plug it into the jack MIC2. Headphones are plugged into the **PHONES** connector;

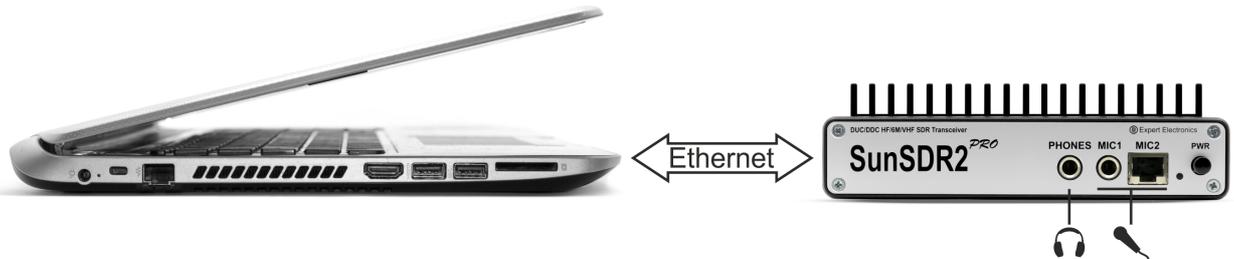


Figure 3.1 – In the standard conditions the headphones and the microphone are connected to SunSDR2 PRO transceiver

2. Connect HF-antenna to connector A3;
3. Connect CAT5 Ethernet cable between PC and transceiver;



Figure 3.1.1 - "ON/OFF" button location. Left top corner.

4. Turn "On" the transceiver: Red rectangle left top corner. Figure 3.1.1 above.
5. Open menu **Options**→ **Device** and set the check boxes in accordance with the figure 3.2:

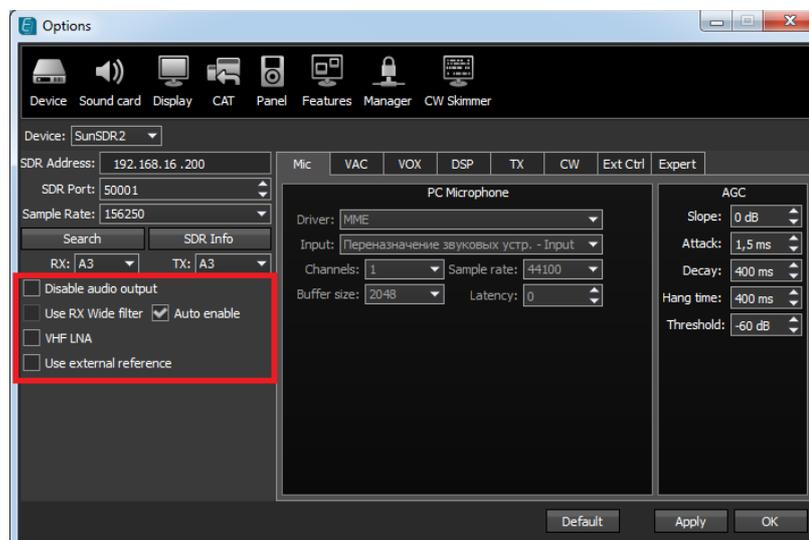


Figure 3.2 – Transceiver's settings

6. In the main ExpertSDR2 software dialogue window specify the connector to which your microphone is connected (see Figure 3.3 below);

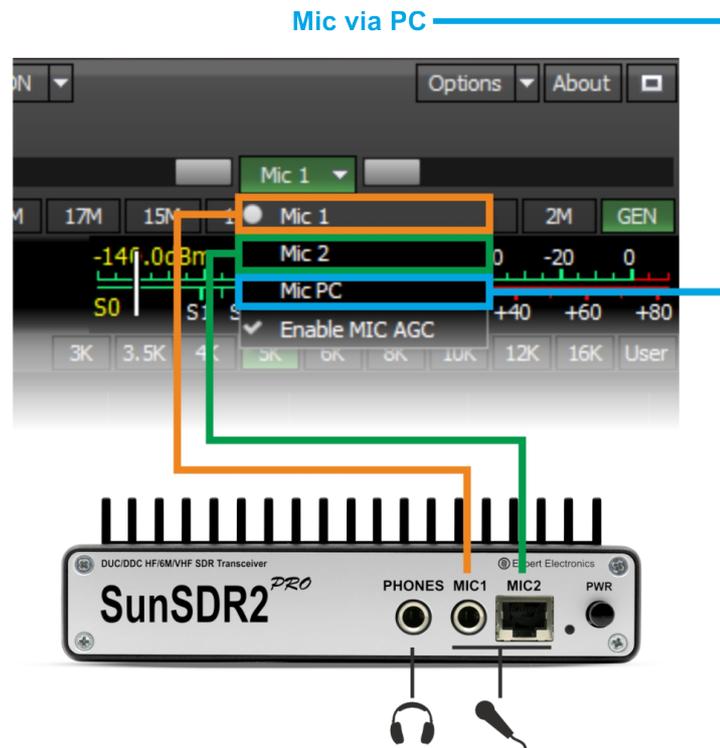


Figure 3.3 – Selecting correct microphone inputs of the transceiver

7. Go to **Sound Card** menu and verify check box “Enable” is unchecked. See figure 3.4;

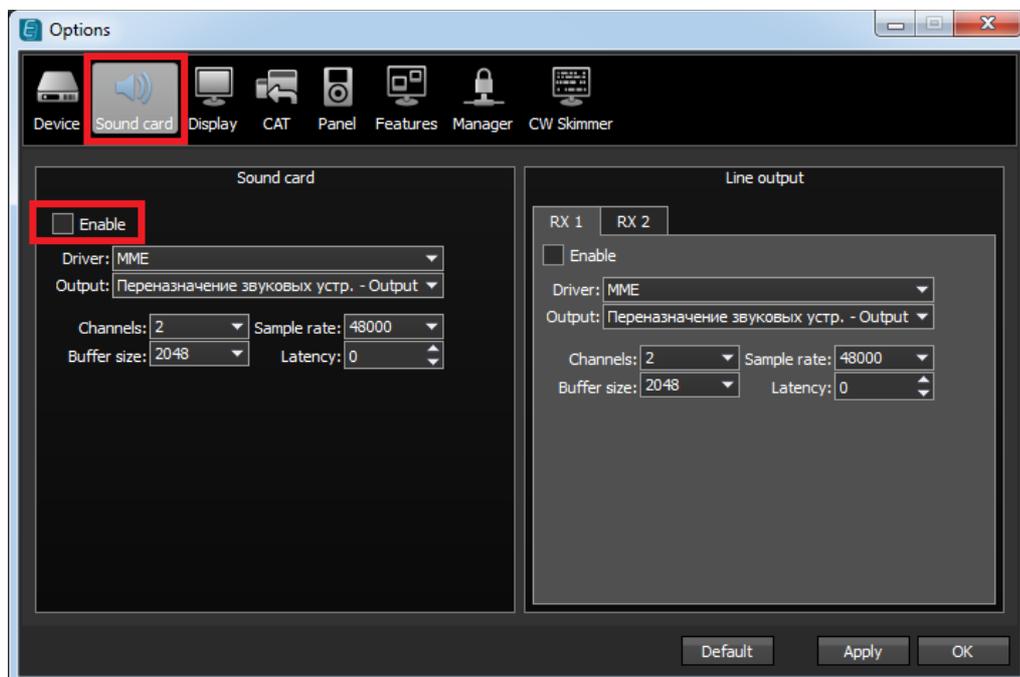


Figure 3.4 – Controlling the microphone inputs of the transceiver

8. Click OK. If everything is done correctly, you will see the air noise track on the panoramic display and hear the sound in the headphones.

## 4. Remote operation

SunSDR2 PRO transceiver has the ability to work remotely.

1. Connect the headphones and microphone or the PC headset to the sound card of the PC (see figure 4.1);

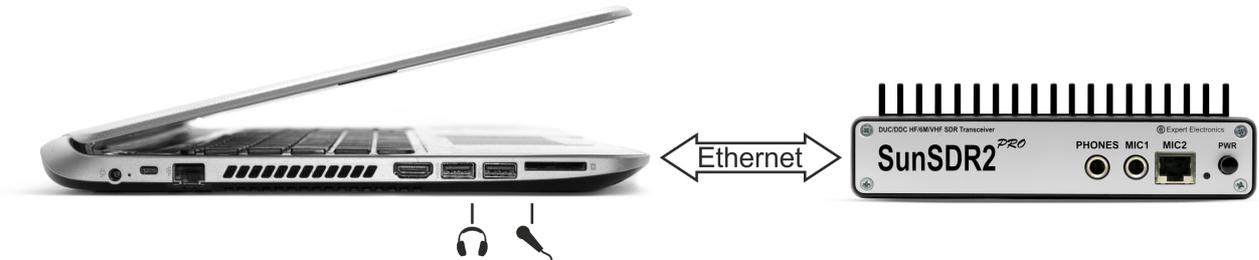


Figure 4.1 – Connecting headphones and microphone when work remotely

2. Connect HF-antenna to connector A3;
3. Set up a wired LAN connection to a PC. For that read the [Getting Started Manual](#) for details at the manufacturers web-site;
4. Turn on the transceiver;
5. Open menu **Options**→ **Device** and set the check box in accordance with the figure 4.2:

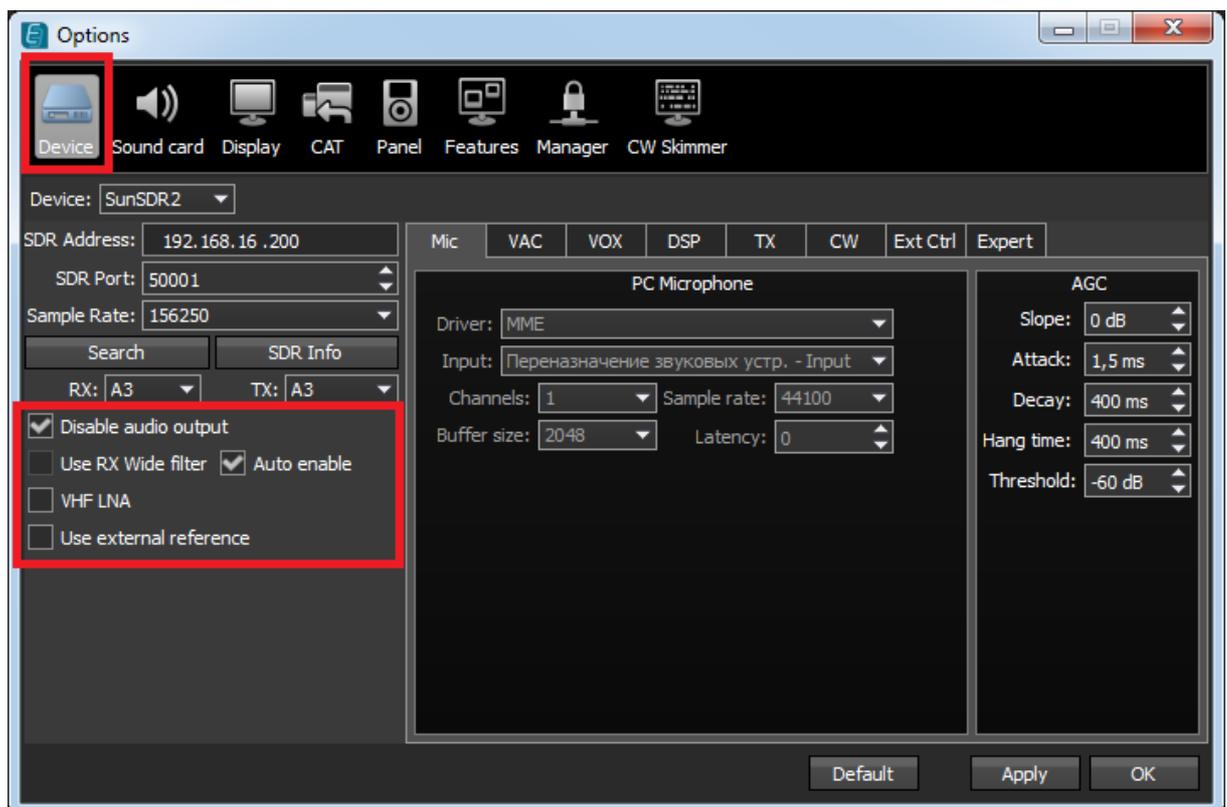


Figure 4.2 – Transceiver's settings

6. In the Sound Card menu choose Driver and select input and output devices and click the check box Enable (see Figure 4.3);

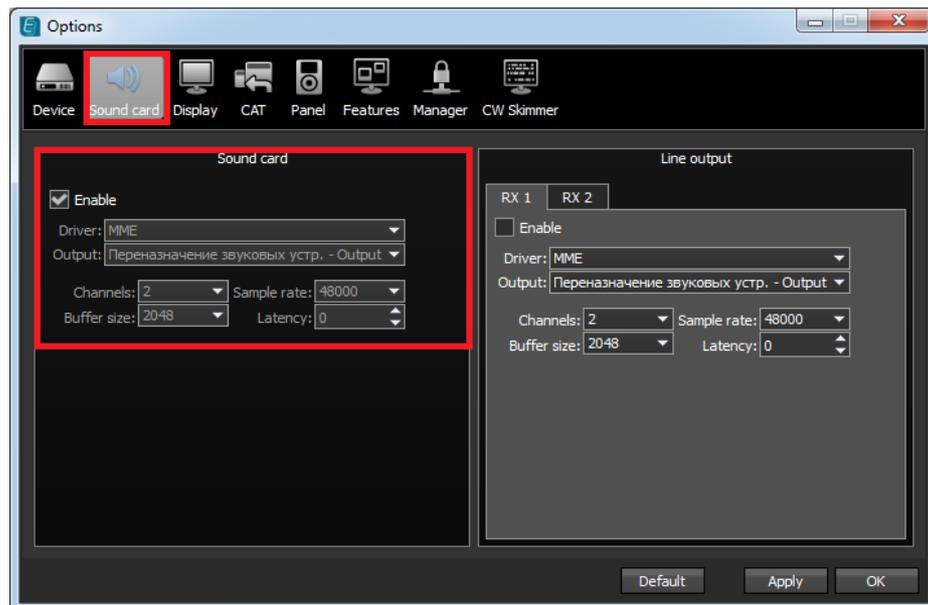
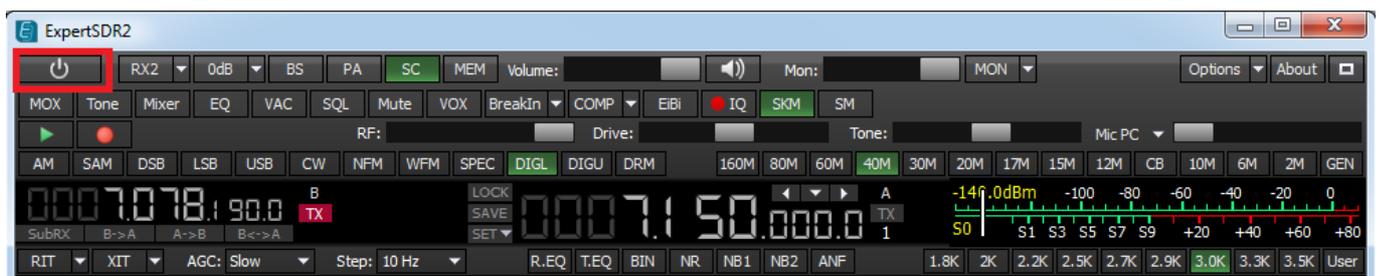


Figure 4.3 – Transceiver's settings

7. Choose MicPC in the drop down menu of the main program window (see Figure 4.4);



Figure 4.4 – Choose the microphone connected to PC

Figure 4.5 – Press **Start** button to turn radio "ON"

8. Press the **Start** button in the software (Left top corner of Figure 4.5). If everything is done correctly, you will see the air noise track on the panoramic display and hear the sound in the headphones.

You are good to go!

## 5. Operation

### 5.1 Operating controls

Transceiver SunSDR2 PRO has several external operating controls. Transceiver's front panel (see Figure 5.1) has connectors for headphones and two types of microphones, dynamic and electret, LED to indicate the operation modes and power switch. Rests of operating controls are placed on the rear panel (see Figure 5.2).

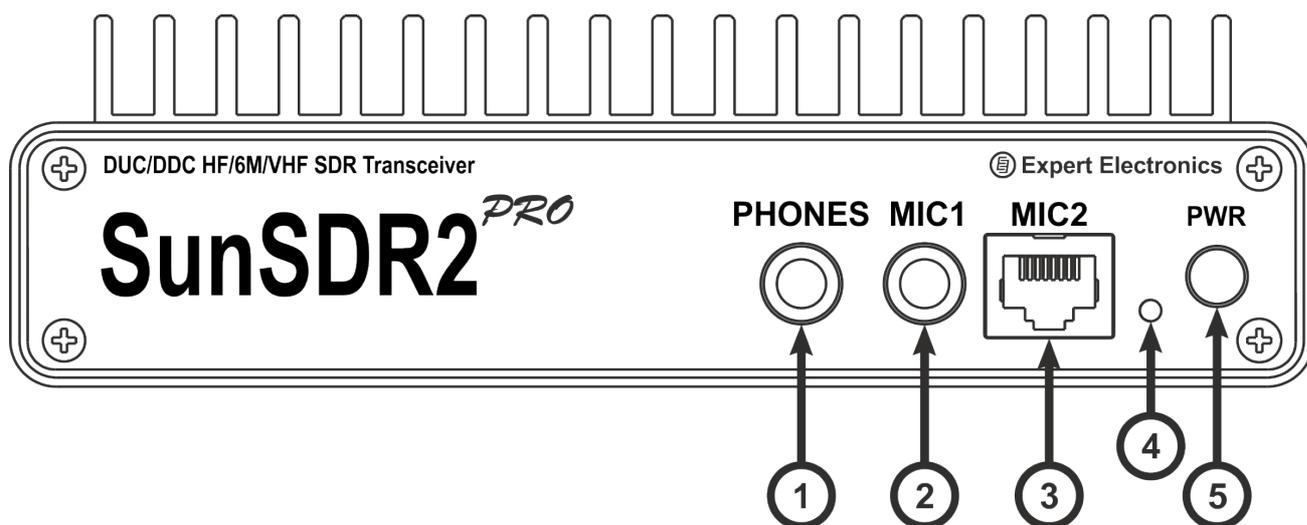


Figure 5.1 – Front panel of the transceiver

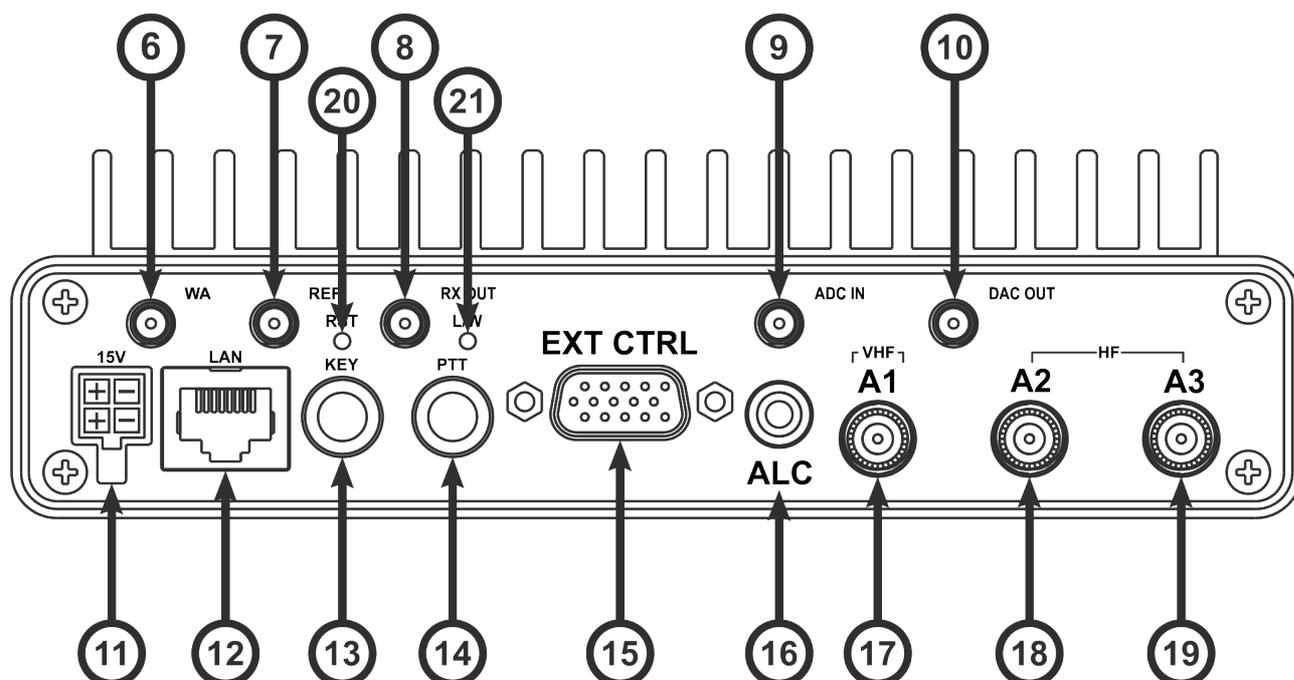


Figure 5.2 – Rear panel of the transceiver

Pin out of the power connector (see Figure 5.3).

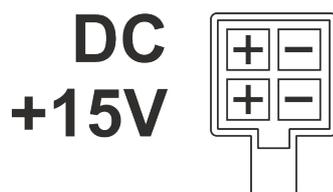


Figure 5.3 – The power connector pinout

Table 1 – Description of the operating controls

| No  | Operating controls description  | Comments  |
|-----|---|---|
| 1.  | Jack for connecting the headphones  | Headphones with the resistance 16-32 Ohm or active dynamics can be connected to this jack   |
| 2.  | Jack for connecting the electret microphone                                 | Electret microphone of the PC's headset or similar can be connected to this jack  |
| 3.  | Jack for connecting the dynamic microphone                                  | This jack is intended to connect the dynamic microphone MH-31 or any other dynamic microphone with the connector RJ-45 and corresponding pinout   |
| 4   | Power indication LED  | This indicator displays operation modes of the transceiver: <ul style="list-style-type: none"> <li>- <b>green</b> color: LAN is active/connected;</li> <li>- <b>orange</b> color: WiFi is active/connected (when the transceiver has a WiFi option);</li> <li>- <b>red</b> color: transmit mode is "ON";</li> <li>- blinking <b>green</b> or <b>orange</b> color: network setup state, wait for a solid color.</li> </ul> |
| 5.  | Power button  | This button switches on and off the transceiver's power   |
| 6.  | Connector for connecting of WiFi antenna                                    | This connector is installed when the transceiver has a WiFi(WLAN) option  |
| 7.  | Input of the external reference oscillator 10MHz<br>10 MHz CMOS level input | Voltage with the amplitude of 10-13 dB/mW and frequency 10MHz can be applied to this input.<br><br><b>Warning!</b> Improper use or higher voltage may damage the transceiver!   |
| 8.  | RX OUT  | Output of the internal receiver's front-end<br><br><b>Warning!</b> Improper use or higher voltage may damage the transceiver!   |
| 9.  | Connector of the ADC uncomplemented input                                   | This connector is intended for connection the external signal sources to the input of high-speed ADC directly, bypass all the filters.<br><br><b>Warning!</b> Improper use or higher voltage may damage the transceiver!  |
| 10. | Connector of the direct output of high-speed DAC                            | Connector is intended for direct connection of the external devices to the output of the high-speed   |

|            |   |  |
|------------|---|--|
|            |   | DAC, bypass all the filters, amplifiers, etc.<br><br><b>Warning!</b> Improper use or higher voltage may damage the transceiver!  |
| 11.        | Power connector   | Connector is intended for connection of DC power source with voltage of up to +15V and maximum load current 5A.<br>Transceiver schematic incorporates shutdown circuit protecting device from the power polarity reversal.   |
| 12.        | LAN connector   | Connector is intended for connecting the transceiver to the local network via LAN cable  |
| 13.        | Telegraph key connector (CW)  | Connector is intended for connection of the telegraph key. Polarity of dots/dashes can be changed in the software. See Page 17.  |
| 14.        | PTT footswitch connector  | Connector is intended for connecting the PTT footswitch  |
| 15.        | External control connector (EXT CTRL)                                 | Connector is intended for controlling the external devices, pinout is shown at the figure 6.3<br><br><b>Warning!</b> Improper use of this connector can damage keys with open collector and damage the transceiver!  |
| 16.        | ALC input   | ALC input for external power amplifier   |
| 17.        | Connector A1 for VHF antenna  | Connector is intended for connection the VHF antenna. Antenna should be connected to this connector when receiving and transmitting signals with the frequencies on 2m band.<br><br><b>Note!</b> All the antennas from connectors A2 and A3 should be disabled during the VHF receipt! |
| 18,<br>19. | Connectors A2 and A3 for HF antennas                                  | HF antennas should be connected to connectors A2 and A3 when operating HF or 6m. Control of the antenna switch is done from ExpertSDR2 software.   |
| 20.        | Button to reset transceiver's IP-address settings to default settings | This button is intended to reset IP-address and UDP-ports of the transceiver to the default IP values: 192.168.16.200, ports: 50001, 50002. Instructions how to reset transceiver's IP address are provided in Clause 5.2.   |
| 21.        | Button to switch operating modes between LAN and WLAN (Wi-Fi)         | This button is intended to switch the transceiver from LAN to WLAN. If WLAN option is not installed, transceiver will not operate when the WLAN mode is selected. Single pressing of the button changes operation mode.  |

## 5.2 Default Settings

Sometimes it is necessary to reset transceiver's settings. Follow steps below:

1. Switch off the transceiver's power supply with **PWR** switch;
2. Press **RST** button on the rear panel of the transceiver and hold it. You will hear a light click;
3. Switch "ON" transceiver's power supply with **PWR** switch. The LED will blink different colors (green and red);
4. Release **RST** button;
5. Wait until the LED turns to green color. Solid green color indicates the completion of the reset of the transceiver's settings to default settings.

"Deep" reset. Follow steps below:

1. Switch off the transceiver's power supply with **PWR** switch ;
2. Press simultaneously the buttons **L/W** and **RST** on the rear panel of the transceiver and hold them;
3. Switch "ON" transceiver's power supply with **PWR** switch. The LED will blink different colors (green and red);
4. Release **RST** and **L/W** buttons;
5. Wait till the LED turns to solid green color;
6. Solid green color indicates the completion of the reset of the transceiver's settings to default settings.

After the reset procedure transceiver will have the IP-address by default 192.168.16.200 and ports 50001 and 50002.

### **Warning!**

Do not switch "Off" transceiver's **PWR** button while LED is blinking.

After switching on the RST button won't be active. Pressing it doesn't have any effect.

## 6. Terminal descriptions

### 6.1 EXT CTRL pinout

Connector EXT CTRL is intended for control of external devices, such as power amplifiers, antenna switching units and tuners, wide of narrow band-pass filters. Control is done directly from SDR-software. At figure 6.1 is given the layout of the connector at the transceiver's rear panel and its pin-out.

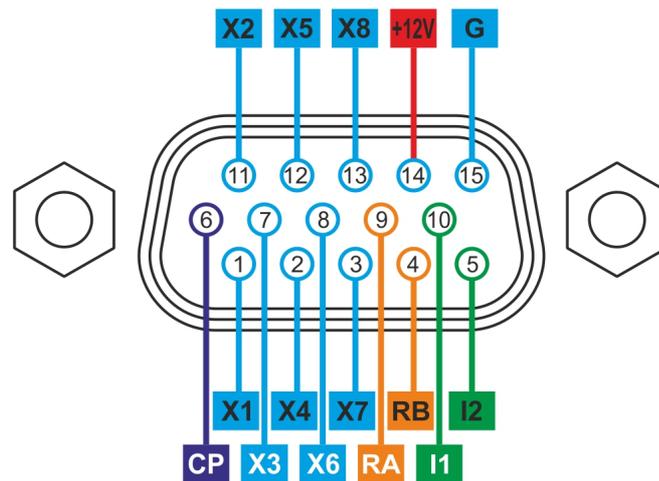


Figure 6.1 – Layout and pinout of the EXT CTRL connector. View from back of transceiver.

Table 2 – Pins description of the EXT CTRL connector

| No. | Pin Name | Description  |
|-----|----------|--|
| 1.  | X1 – X7  | Open collector's pins (programmable I/O with software)   |
| 2.  | X8       | Open collector's pin for control of PTT for external PA  |
| 3.  | CP       | Protective diode pin   |
| 4.  | +12V     | Pin for power supply +12V, MAX current 0.5 A<br><br><b>Attention! Do not connect</b> loads with current above 0.5 A, it will damage transceiver. |
| 5.  | G        | Transceiver's ground terminal  |
| 6.  | I1, I2   | Button sensors, works on the input   |
| 7.  | RA, RB   | RS485 Interface  |

## 6.2 MIC1 pinout

Connector MIC1 is intended for connection the electret microphone, PC headset or any other electret microphone, which is intended to work with PC. Connector JACK6.3 to JACK 3.5 is used for connection (included into the set). Circuit diagram for the electret microphone is shown at the figure 6.2.

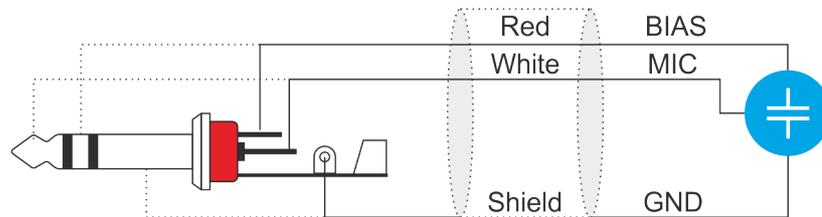


Figure 6.2 – JACK 6.3 mm connector pinout for connection to MIC1

## 6.3 MIC2 pinout

Dynamic microphones are less sensitive to the extraneous noises due to greater focus. Dynamic microphones have a higher speech quality and signal/noise ratio during operation.

MIC2 connector is intended to connect the dynamic microphones. This connector has a pinout which corresponds to the dynamic microphone. At the figures below you can find the appearance of dynamic microphone MD-15 (figure 6.3), PTT diagram (figure 6.4) and the direction of numbering (figure 6.5).



Figure 6.3 – The appearance of the PTT MD-15.

The PTT diagram consists of the dynamic microphone and the minimum amount of details. It includes the button PTT which moves the transceiver in transmit mode.

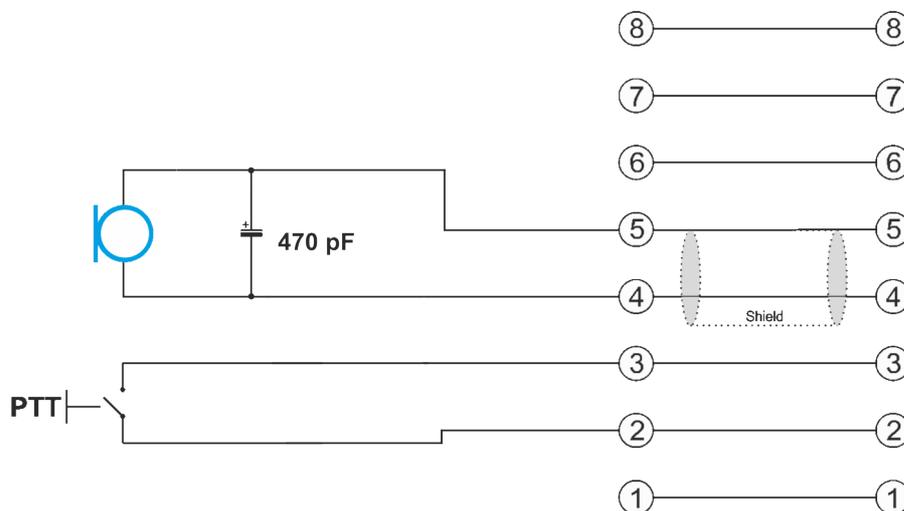


Figure 6.4 – Pin description of the dynamic microphone connector

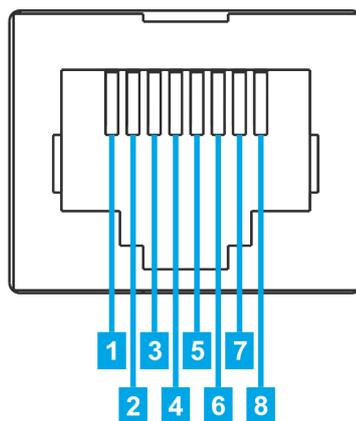


Figure 6.5 – Pin description of MIC2 connector and the direction of numbering. View from front of connector.

## 6.4 PTT footswitch cable pinout

The PTT footswitch is intended for switching the SunSDR2 PRO transceiver into transmit mode. Cable pinout is given at figure 6.6, appearance – figure 6.7.

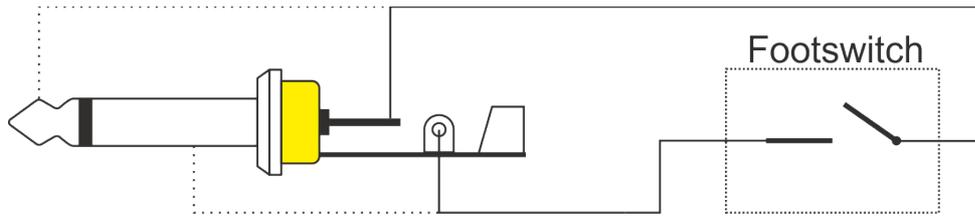


Figure 6.6 – Cable pinout for connecting the PTT footswitch



Figure 6.7 – PTT footswitch appearance

## 6.5 CW-keyer connector pinout

Different CW-keyers have different connectors, the cable for it should be produced individually. JACKs 6,5 mm are also used for connection to PC. The CW key jack pinout is provided at the figure 6.9.

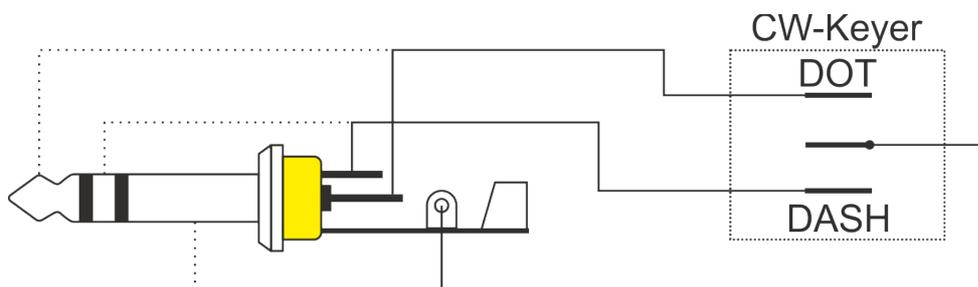


Figure 6.9 – CW-keyer connector pinout

### 6.5.1 Changing of CW Paddle Polarity

Use BreakIn drop down menu: Iambic/Reverse paddle. Normal and reverse polarity can be selected as well as Iambic.

## 7. Regulatory requirements



We Expert Electronics LLC.

6 "V" Lesnaya Birzha St., Taganrog,  
Rostov Region, Russian Federation, 347900

declare that **SunSDR2 PRO transceiver** has been tested in accordance to essential protection requirements of the R&TTE Directive 1999/5/EC on the approximation of the laws of the Member States relating to **Radio Spectrum Matters** and found the test results indeed meet the limitation of the relevant test standard(s) listed below:

EMC

EN 301 489-1: V 1.9.2 (2011)  
EN 301 489-15: V 1.2.1 (2002)

Radio Spectrum

EN 301 783-1: V 1.2.1 (2010)  
EN 301 783-2: V 1.2.1 (2010)

Type of Equipment: Base Station  
Equipment Class: B

The system is to be operated in accordance with the laws of the telecommunications regulatory agency in the country of use. A license is required to use this equipment, and the operator must comply with the national frequency allocations for the county of use.

Testing Company: Worldwide Testing Service (Taiwan) Co., Ltd.  
Place of issue: 6F, NO.58, LANE 188, RUEY-KUANG RD., NEIHU, TAIPEI 114, TAIWAN, R.O.C.  
Date of testing: August 14, 2015  
Person Responsible: Rex Kao (Signature on file)

### RoHS Directive

Expert Electronics LLC confirms that we place on the market products sourced from suppliers who have confirmed that their products are RoHS compliant. Expert Electronics LLC declares that this equipment complies with the restriction of the use of certain hazardous substances in electrical and electronic equipment.

### Waste Disposal

The device may not be disposed of with household waste! This device complies with EU Directive on Electronic and electrical equipment (WEEE regulation) and will therefore not be disposed of with household waste. Dispose of the device to your local collection points for electronic equipment!



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V1.1 - 28.10.2015